

**Abstract**

A battery power supply has a primary battery to provide long service life and a secondary battery to provide short instantaneous power pulses required by loads with variable duty cycles and pulsatile load profiles such as digital cellular phones. The primary battery is linked to the power pulse battery in parallel and in series to the load. In the pulse battery, one of the electrodes has at least two electroactive materials as components of the same electrode. These different electroactive materials are selected to have different discharge potentials, charging potentials, and voltage outputs. One of the materials provides a voltage output of a predetermined level and the other of the materials lowers the overall charging voltage of the electrode below that of the first material. The mixed electrode in the pulse battery permits the pulse battery to be charged by the primary battery during the off-pulse periods throughout a substantial portion of the entire discharge voltage range of the primary battery. Thus, the primary battery is not required to provide very tight voltage ranges over its discharge cycle or history during operation with a pulsatile load. The primary battery may be a zinc-air battery. The primary battery should be sized and selected such that it supplies most of the energy when the two are connected in parallel. Various circuit configurations permit the energy and pulse batteries to work together by switching out parasitic loads, limiting current, and selectively augmenting the average power capacity during lower-power modes of connected appliances.